FLOOD PLAIN MANAGEMENT STUDY

TOWN OF ALMIRA

LINCOLN COUNTY, WASHINGTON

SEPTEMBER 1987

LINCOLN COUNTY CONSERVATION DISTRICT
TOWN OF ALMIRA
WASHINGTON STATE DEPARTMENT OF ECOLOGY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TABLE OF CONTENTS

TOWN OF ALMIRA FLOOD PLAIN MANAGEMENT STUDY

INTRODUCTION:

Flood Plain Management Study assistance is targeted to communities where flood damages are a serious problem and local governments are sincerely interested in taking actions to reduce present and future damages. The study will provide guidelines for managing and planning the development of land within the town of Almira.

REQUESTING AUTHORITY:

In June of 1983 the town of Almira sent a request to the Office of Planning Development, Washington Department of Ecology (DOE) requesting a detailed hydrologic study of the several streams flowing through the town. DOE then requested SCS to make the study using the Flood Plain Management Program.

AUTHORITY FOR THE FLOOD PLAIN MANAGEMENT STUDY:

Authority for carrying out Flood Plain Management studies is provided in Section 6 of Public Law 83-566, which authorizes the Department of Agriculture to cooperate with other federal, state, and local agencies to make investigations and surveys of watersheds, rivers and other waterways as a basis for the development of coordinated programs. A description of the program is covered in Subpart C of Part 621, 40 FR, 12474, March 19, 1975. Flood Plain Management studies performed by the SCS respond to recommendations in the report by the Task Force of Federal Flood Control policies, House Document No. 465 (89th Congress, August 10, 1963); especially recommendations 9 (C), Regulations for Land Use. In carrying out the flood studies, the SCS is also responding to Executive Order 11988, Flood Plain Management, and Executive Order 11990, Protection of Wetlands, both effective May 24, 1977.

THE PURPOSE OF THE STUDY:

The purpose of this technical study is to provide flood hazard and other related information to the involved local governments and residents of the study area. This study provides alternatives to solving/reducing the flooding which affects the town of Almira.

DESCRIPTION OF THE STUDY AREA:

Almira, with a population of 349, is located approximately 75 miles west of Spokane, along State Highway 2. The study area includes the corporate boundaries of the town of Almira, Lincoln County, Washington. It is in the Lincoln County Conservation District. The study area, (see Study Area Map, page 3) is in hydrologic unit 1702013 in subwatershed 055. Davis Creek which floods the town of Almira is a tributary to Corbett Draw. Corbett Draw in turn is a tributary to Wilson Creek which is a tributary to Crab Creek. The Almira watershed has a drainage area of 7,500 acres (11.7 square miles) above the town limits. Land use within the watershed is predominately nonirrigated cropland in a winter wheat and fallow cropping system with some stringers of native rangeland intermixed. The climate of the region is influenced by both the Pacific Ocean and the Inland Basin areas. Summers are warm, dry and sunny with few hot days. In winter, weather systems moving eastward across the state and occasional outbreaks of cold air from Canada result in frequent changes in the atmospheric conditions. Cold snaps are not infrequent but continued cold weather is unusual. Average annual precipitation is near 10 inches.

Almira is located in the northwestern portion of the Washington Palouse Region. It is characterized by rolling hills. Slopes range from nearly level to steep. Native vegetation includes grass and sagebrush. Elevations range from 1900 feet in Almira to over 2800 feet along ridgetops in the northern watershed.

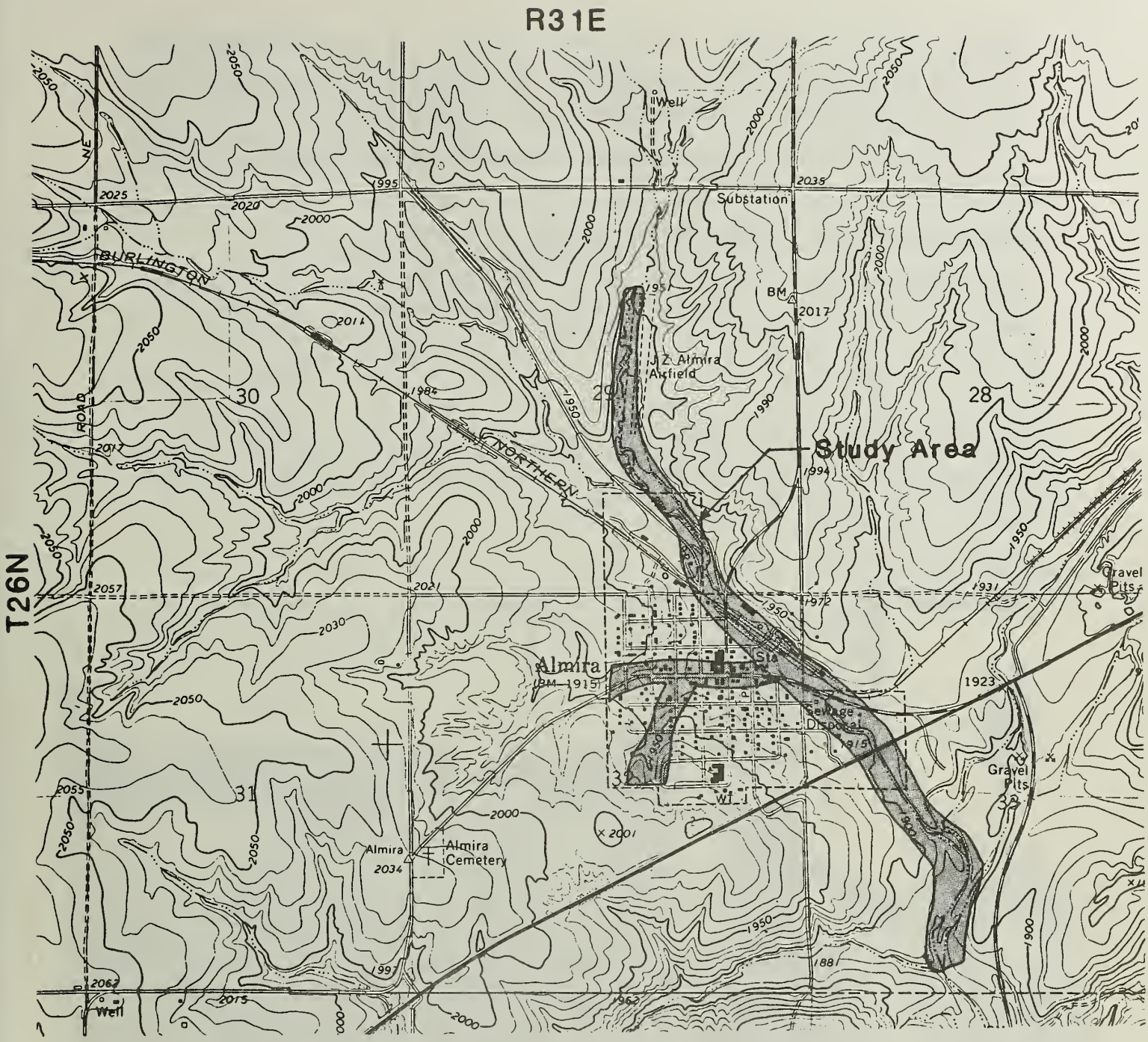
SOILS:

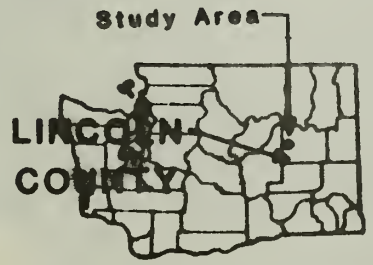
The dominant soils in the area are Renslow, Bagdad, Esquatzel, Pedigo, and Anders. The Renslow soil is very deep and well drained. It formed in loess on broad ridgetops on uplands. The annual precipitation is 10 to 13 inches and the frost-free season is 130 to 150 days. The main limitation when used for cropland is the low annual precipitation.

Bagdad soils are along the northern edge of the study area. The Bagdad soil is very deep and well drained. It was formed in loess on uplands. The annual precipitation is 12 to 15 inches and the frost-free season is 110 to 140 days. It has few limitations when used for cropland.

The Esquatzel and Pedigo soils are on bottomlands. The Esquatzel soil is very deep, well drained. It formed in alluvium derived from loess. The annual precipitation is 6 to 12 inches and the frost-free season is 130 to 150 days. The main limitation when used for cropland is the low annual precipitation.

The Pedigo soil is very deep, somewhat poorly drained. It formed in alluvium derived from a mixture of loess and volcanic ash. The annual precipitation is 10 to 16 inches and the frost-free season is 130 to 160 days. The main limitation when used for cropland is the hazard of flooding and the seasonal high water table.





LOCATION MAP

STUDY AREA MAP
FLOOD PLAIN MANAGEMENT STUDY
TOWN OF ALMIRA
LINCOLN COUNTY, WASHINGTON

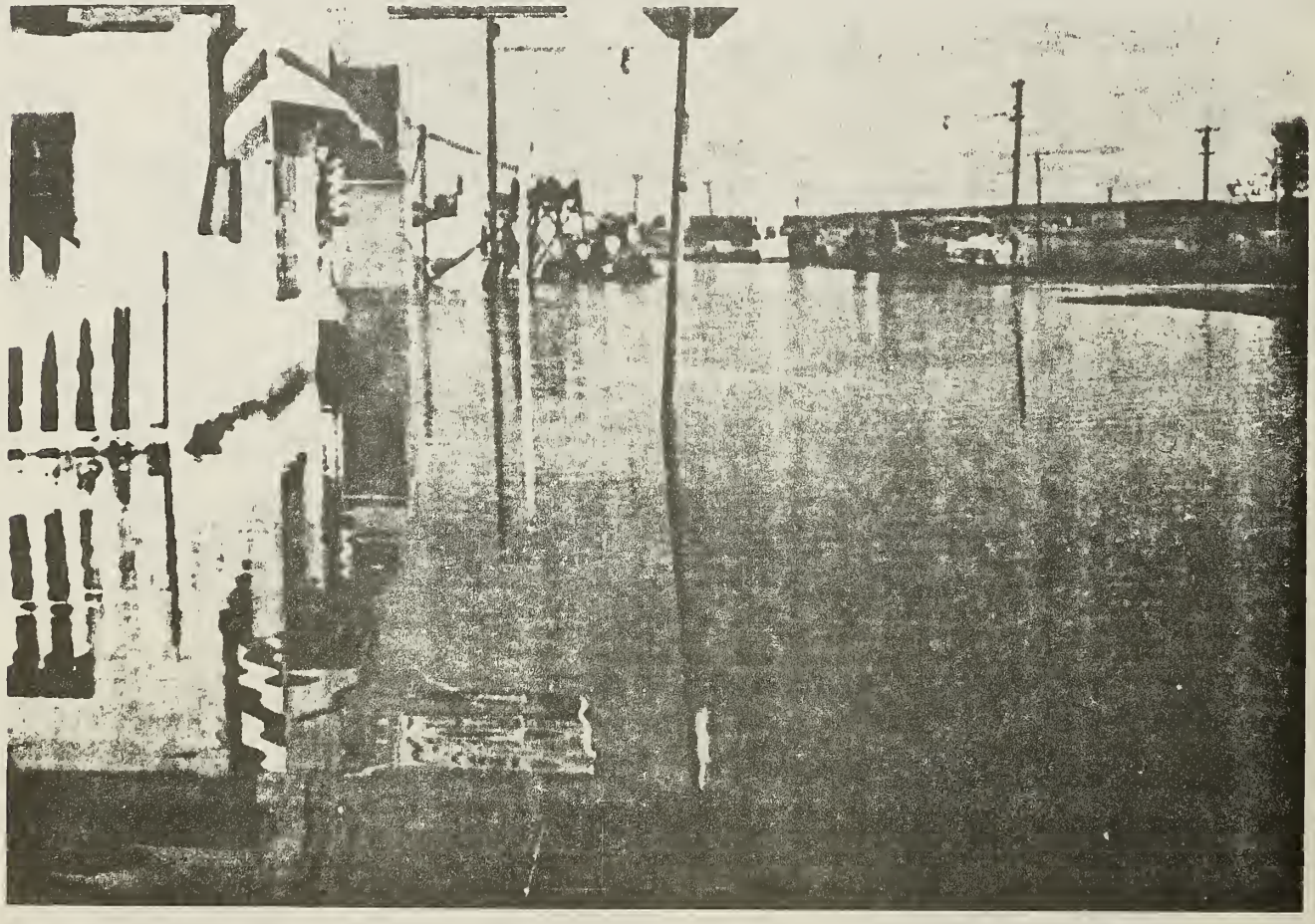
N

The Anders soil is moderately deep, well drained. It formed in loess over fractured basalt on plateaus. The annual precipitation is 12 to 16 inches and the frost free season is 120 to 150 inches. The main limitation when used for cropland or rangeland is the moderate depth to basalt.

Soils of minor extent include Adkines, Bakeoven, Condon, Ritzville, Emdent, Roloff, Willis, and Starbuck.

NATURAL AND BENEFICIAL FLOOD PLAIN VALUES:

Vegetation in the flood plain is associated with the stream corridor and includes such species as basin wild rye, foxtail, cattail, sweet clover, an abundance of noxious weeds including Canadian thistle, Chinese lettuce, and cheatgrass. The flood plain does contain two city parks where picnicking and baseball are the primary uses. Flow within Davis Creek is flashy, when there is water, there is lots of water. Once this is gone, it's a small trickle which only maintains the vegetation along the bottom of the stream. The habitat along the steam corridor would contain basically nongame varieties and small birds. Stream channel work has been performed in the past, but no record of the latest work was available.



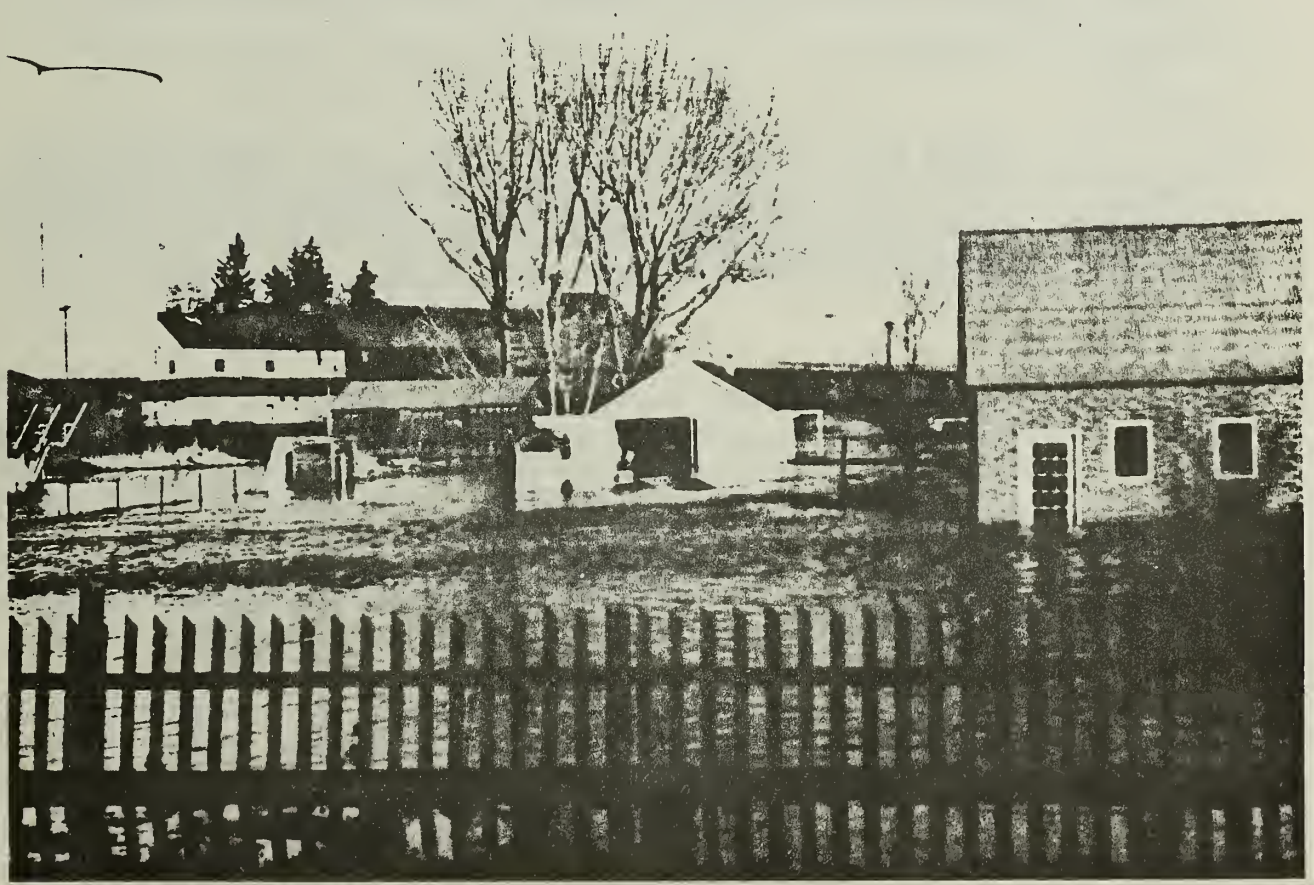
FLOOD PROBLEMS:

Most flooding in the watershed has been during the summer months and is associated with thunderstorm events which tend to follow the southeast by northwesterly trending ridges. Winter chinook storms have produced some minor flooding events; however, the major events appear to be thunderstorm related.

Historical floods that caused significant damages occurred in 1957 and 1975. The 1975 flood was estimated by the Corps of Engineers to have been greater than a 100-year event. Flood damages for the 1975 event were estimated to have been over $350,000 ($675,000 in 1986 dollars). Approximately 14 residences, 18 commercial businesses and buildings, two public facilities and roads, streets and bridges were damaged.

FUTURE FLOODING:

Future flooding is projected to continue at approximately the present rate over the next 10 or 20 years. The town of Almira is a small, rural farming community. No changes in the physical characteristics of the watershed that would significantly affect the rate of runoff are expected. Monetary flood damages will increase on the flood plain as inflation increases the value of existing flood plain property and as repair and improvements are made to existing properties. The town of Almira does have an existing flood insurance study from which it has developed flood plain regulations which will help to minimize future flooding and monetary flood damages.



OTHER PROBLEMS:

Most of the watershed is utilized for the production of cereal crops with winter wheat being the predominate. Other crops include winter barley and spring wheat. Erosion and runoff from the cropland is highest during the years after fallow when the pounds of crop residue left on the land is low. Some of the steeper slopes in the upper watershed are in rangeland with some grazing use. The rangeland suffers from some concentrated flow erosion, but contributes only minor amounts of sediment to the stream.

Based on a current inventory of damageable property on the flood plain, a total of 18 residences, 26 commercial/public buildings and roads, streets and bridges would be damaged during a 100-year flood event. Total damages anticipated from such a flood today would total nearly $600,000 dollars. Based on current hydrology and stream channel capacity, out-of-bank flow occurs around a 20-year storm event. Estimated average annual damages to the watershed total $22,500.

ANALYSIS:

Data source

Basic data in the study include U. S. Geological Survey topographic maps, bench marks, streamflow records and U. S. Army Corps of Engineers flood insurance studies including steam channel cross sections and profiles, and 100-year flood plain maps. Precipitation data used to develop storm runoffs is from U. S. Department of Commerce NOAA Atlas II maps. Soils data is from the Soil Survey of Lincoln County, Washington published by the USDA, Soil Conservation Service.

Hydrology

There are no stream gage records for Davis Creek in the Almira Watershed. Hydrology for this study was based on a regional study done by the Army Corps of Engineers and a TR-20 hydrology computer model which was used to analyze alternative management strategies. (see cover photo - Davis Creek)

Hydraulic Study

Hydraulic studies were completed using the Soil Conservation Service Water Surface Profiles computer program (WSP-2). Field surveys were completed to obtain information for alternative management plans. Evaluation considered only channel and flood plain features existing at the time the field surveys were made. The effects of flow blockage by ice or other debris are undetermined and therefore not considered in the analyses. Such factors as future flood plain scouring or filling, bank erosion, and channel degradation also affect the water surface profiles, but were not evaluated.

Flood Plain Management Options

The town of Almira, in their 1980 comprehensive plan, gave the following goals:

1. To provide for safe development in the areas that are subject to seasonal flooding.

2. To prevent damage to structures that are constructed in the flood hazard area.

Policies

The land development ordinance for the town of Almira presented in 1981 also gives this statement. Section 3.403 Flood Hazard Zone Standards, all uses shall comply with the Flood Hazards prescribed in the Almira Flood Damage Prevention Ordinance, No. 241. Both these reports show the town's concern for protecting the public from present and future flooding.

The following policies were set out by the Almira City Council:

1. To accurately determine the boundaries of the 100-year flood hazard area.

2. To encourage the adoption of an ordinance that would require that all structures built in the flood hazard area have a minimum first floor elevation of one foot above the 100 year flood level.

3. To encourage the continued improvement of the major drainage channel.

4. To encourage the search for state or federal funding for improvement of the major drainage channel.

Proper management of the flood plain can minimize flood damage losses in most flood hazard areas. Several management options are available that could be used by local governments and individual landowners to improve management of the Almira Watershed flood plain. This section discusses those options on a conceptual basis and summarizes the potential for reducing flood damages in the Almira flood hazard area.

Alternatives

Existing flood plain management options include:

A. Land Treatment
B. Non-Structural Flood Control Measures
C. Structural Flood Control Measures

A. Land Treatment

Land treatment would consist of applying conservation practices to the nonirrigated cropland and rangeland areas of the watershed to reduce runoff, erosion and sedimentation of stream channels. Additional vegetative and nonvegetative treatments can be made to the channel itself to reduce streambank erosion.

Treating the cropland areas with conservation tillage and crop residue management practices can reduce the amount of runoff by 30%. This would not significantly reduce downstream flooding to the City of Almira. Costs to install the needed land treatment would range from $20 to $50 per acre with a total cost over $250,000 with an average annual cost estimated at $24,700. Average annual flood damage reduction benefits are estimated to only be $6,500. On-farm benefits from increased soil productivity would be necessary to make this a generally feasible alternative.

The addition of structural land treatment measures, (grassed waterways, terraces, sediment ponds and drop structures) can also be utilized to further reduce the volume of water and erosion produced by the watershed. In order to fully control runoff from cropland areas during flood events 100 year terraces would have to be installed.

B. Non-Structural Measures

Nonstructural measures are protection techniques normally applied to individual buildings. These measures include the following:

1. Acquisition and Relocation
2. Floodproofing
3. Flood warning
4. Flood insurance
5. Regulation Zoning

1. Acquisition and Relocation:

These options are expected to have minor local appeal for implementation because of the high cost, adverse social impacts, and unpopularity with local landowners. Acquisition would include the buying of property which has been flooded more than once, whereas relocation would include removal of the flooded property to another site where the threat of flooding was not present.

2. Floodproofing:

Floodproofing consists of elevating buildings above the 100-year frequency flood by either jacking up the building and extending the height of the foundation, plumbing and other utilities or sealing low openings and porous foundations, or if feasible, intentionally flooding the buildings to equalize the hydrostatic pressure to prevent wall collapse. Floodproofing for the individual buildings would range from $5,000-$15,000. This alternative has average potential for implementation for the community. In the absence of group action, this measure could be used for some individual buildings.

3. Flood Warning:

Flood warning systems normally consist of National Weather Service weather monitoring recording gages to monitor runoff, flood watch, flood warning, and evacuation plans. The limiting factor in the flood warning system for the Almira flood hazard area would be the short warning time available.

Warning time is a product of the hydrologic and hydraulic characteristics of the upstream drainage area. Maximum anticipated warning time for Almira would be less than one hour in most cases. Because of limited warning time, a flood warning system would have a low potential for reducing flood damage. It may, however, provide time for local residents to reach safety in very hazardous situations and during the evening hours.

4. Flood Insurance:

The town of Almira and Lincoln County are participating in the Federal Emergency Management Agency's Flood Insurance Program. There are currently two participants in the Program in Almira. The present insurance rate schedule is based upon approximate studies done by FEMA in 1979. The study done by the Corps of Engineers will provide data for the community to be converted into the permanent flood insurance program.

The Almira flood hazard area is highly developed containing 18 residences and 26 commercial and public buildings within the 100-year flood plain area. Flood insurance would reimburse owners for flood damage losses they sustain while associated management regulations could guide future improvements to avoid developments in areas that would be flood prone. It is anticipated that flood insurance, with a good education program to acquaint local landowners with its advantages, would have a high potential for implementation.

5. Regulation Zoning:

This alternative would have no effect on existing property. The town of Almira has a flood hazard standard prescribed in the Almira Flood Damage Prevention Ordinance No. 241. This standard states that no residence or business shall be built in the flood plain unless the first floor elevation is one foot above the 100-year flood level. The Corps of Engineers has recently completed a flood insurance study for the town of Almira and have designated a floodway.

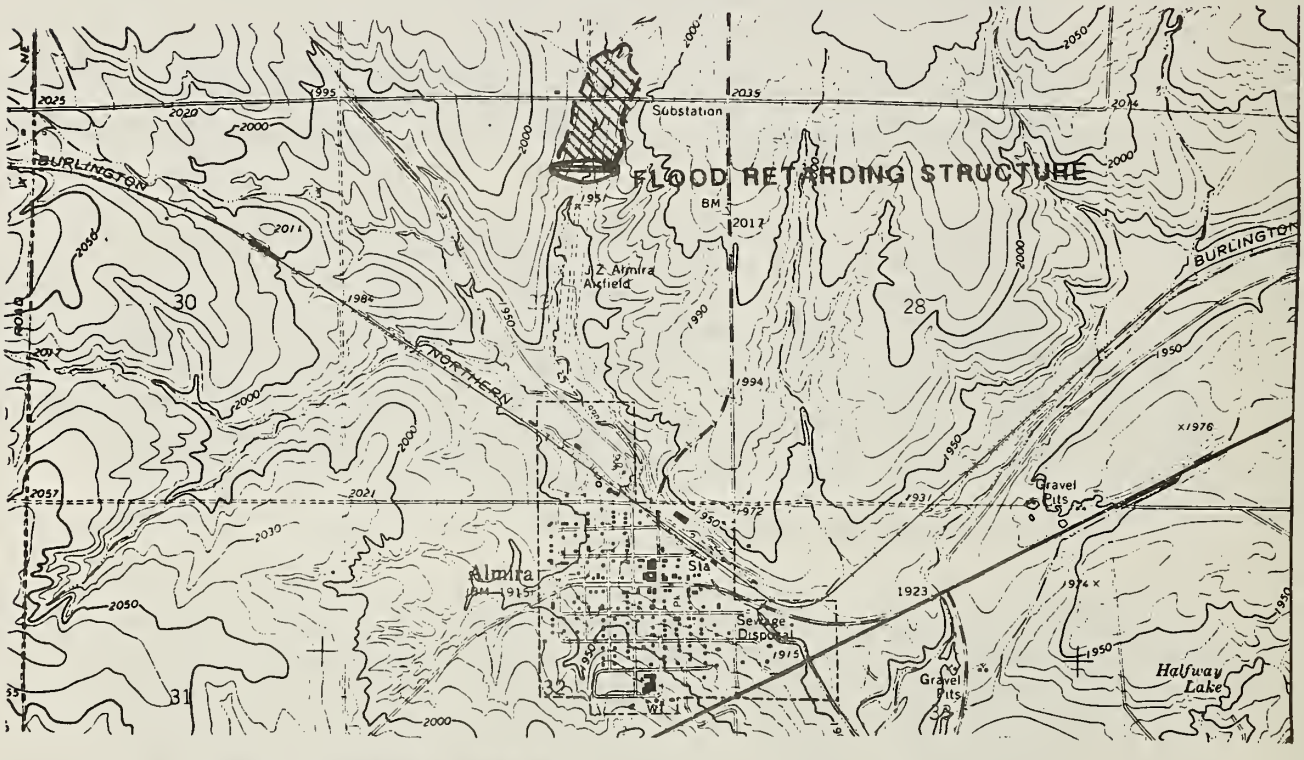
C. Structural Measures

Structural measures considered for providing flood protection to Almira include but are not limited to:

1. Floodwater Retarding Structures
2. Channel improvement
3. Diking
4. Diversions

1. Floodwater Retarding Structures:

One major floodwater retarding structure or several small storage reservoirs could be constructed to control flood runoff (see Figure 1 for one proposed location). Either could provide significant flood prevention benefits but high construction costs would make them unfeasible compared to the damage reduction benefits. Costs to construct floodwater retarding structures would exceed $600,000. Soil materials within the watershed are of poor quality for dam construction. Dams constructed from these materials would require expensive drainage systems to keep the fill in place. Average annual costs would total over $59,000 compared to average annual benefits of $22,500.



ALMIRA FPMS

LARGE DAM ALTERNATIVE

FIGURE 1

2. Channel Improvement:

Channel improvement would include widening or deepening the existing stream, changing its alignment and or lining it with protective materials. Features for fish, wildlife, and visual resource mitigation would also be included. The channel in this alternative would be deepened and widened to contain the 100 year frequency discharge of 2100 cubic feet per second.

Channel improvement would begin above the County Street bridge upstream from the railroad and continue downstream to State Highway 2 (see Figure 2 for proposed location). Channel side slopes of 2:1 and a variable bottom width would be included. Construction would require the removal of approximately 60,000 cubic yards of material at an estimated cost of $250,000.

No buildings would be required to be relocated and existing channel landrights should be adequate for the construction. However, several bridges would have to replaced or removed to provide adequate channel capacity. The costs to replace all existing bridges is estimated at $225,000.

Total costs for this alternative including bridge replacement are $475,000. This alternative would provide a 100-year level of flood protection to the city of Almira, producing an estimated average annual flood damage reduction benefit of $22,500 compared to an average annual cost of $46,900.

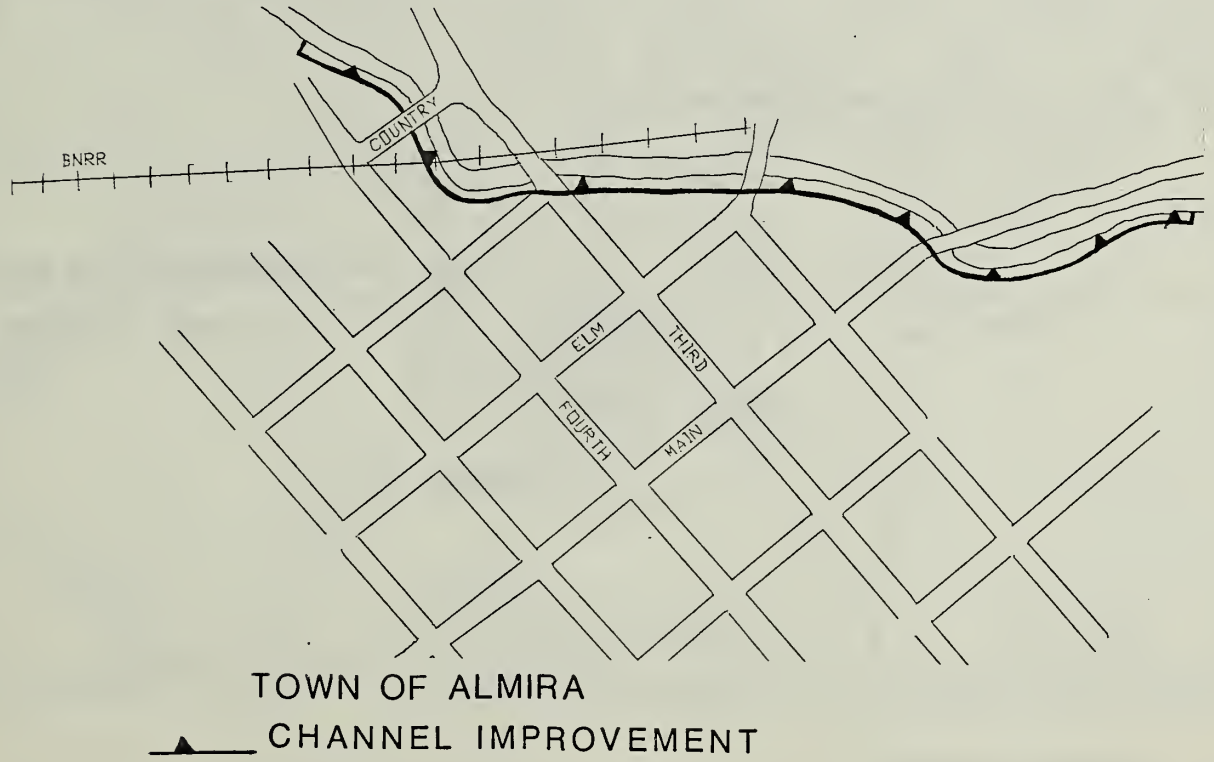


FIGURE 2

3. Dikes:

There is potential for using dikes and/or flood walls to protect the town of Almira. Earthen dikes set back from the existing stream channel could be utilized and landscaped into the existing lots to minimize the visual impact (see Figure 3 for proposed location). The dikes would be at an elevation to contain the 100-year flooding event with a freeboard of 3 feet. Material for the dikes would come from channel excavation.

The estimated cost of providing 100-year protection through the use of dikes is $100,000 or $9,900 average annual. This alternative also provides $22,500 of average annual flood prevention benefits for a feasible cost-benefit ratio of 2.3:1.0.

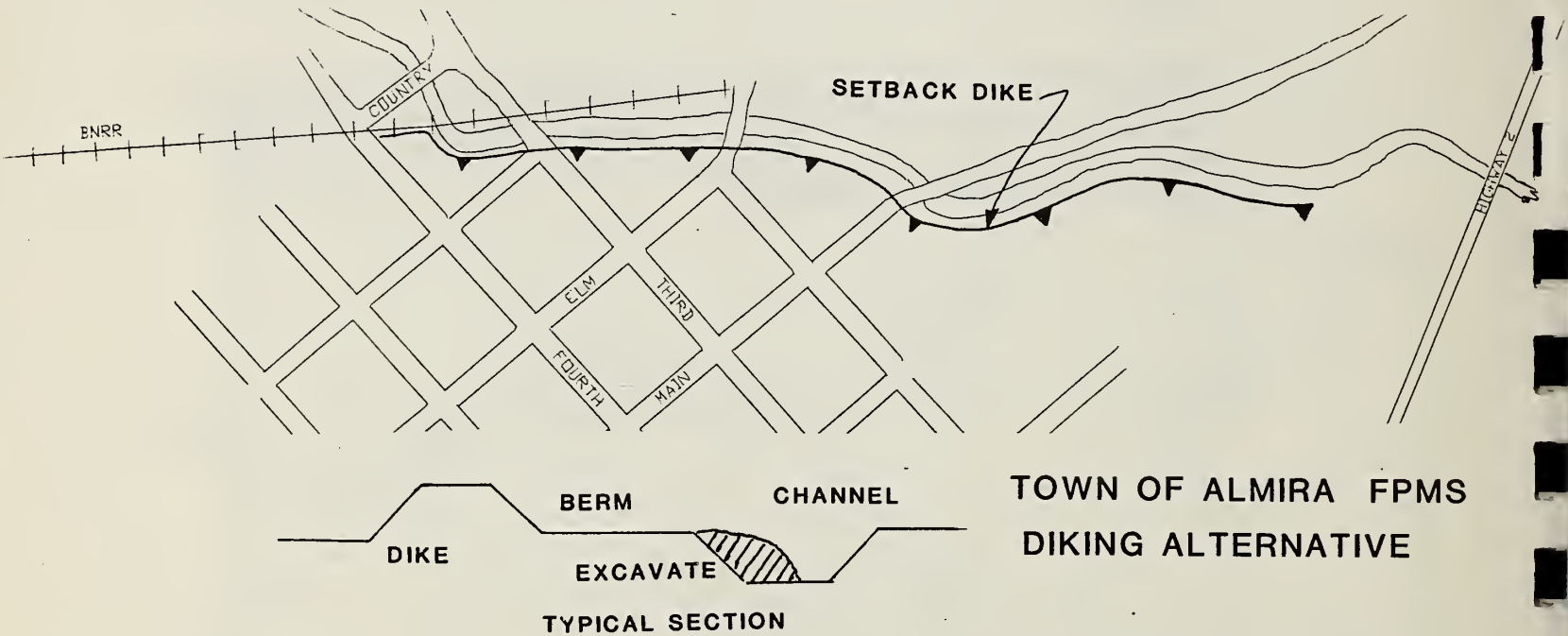


FIGURE 3

4. Diversions:

The diversion would divert water from the major portion of the watershed lying north of town along the east edge and drop the water into Corbett Draw above Highway 2 (see Figure 4 for proposed location). A concrete diversion structure located just south of Road 44NE in Section 29 above the airport would lead water into a 30 foot bottom, 7 foot deep diversion ditch which would run 4600 feet in a south and easterly direction crossing the north-south road between Sections 28 and 29 where a large bridge would need to be installed. This alternative would have the advantage of not disturbing any of the bridges in town, but would remove 10 acres from production. The estimated cost of the main diversion around town would be $550,000. The diversion would reduce the 100-year flow event to in-channel flow through Almira. Average annual costs and benefits would total $54,300 and $22,500, respectively.

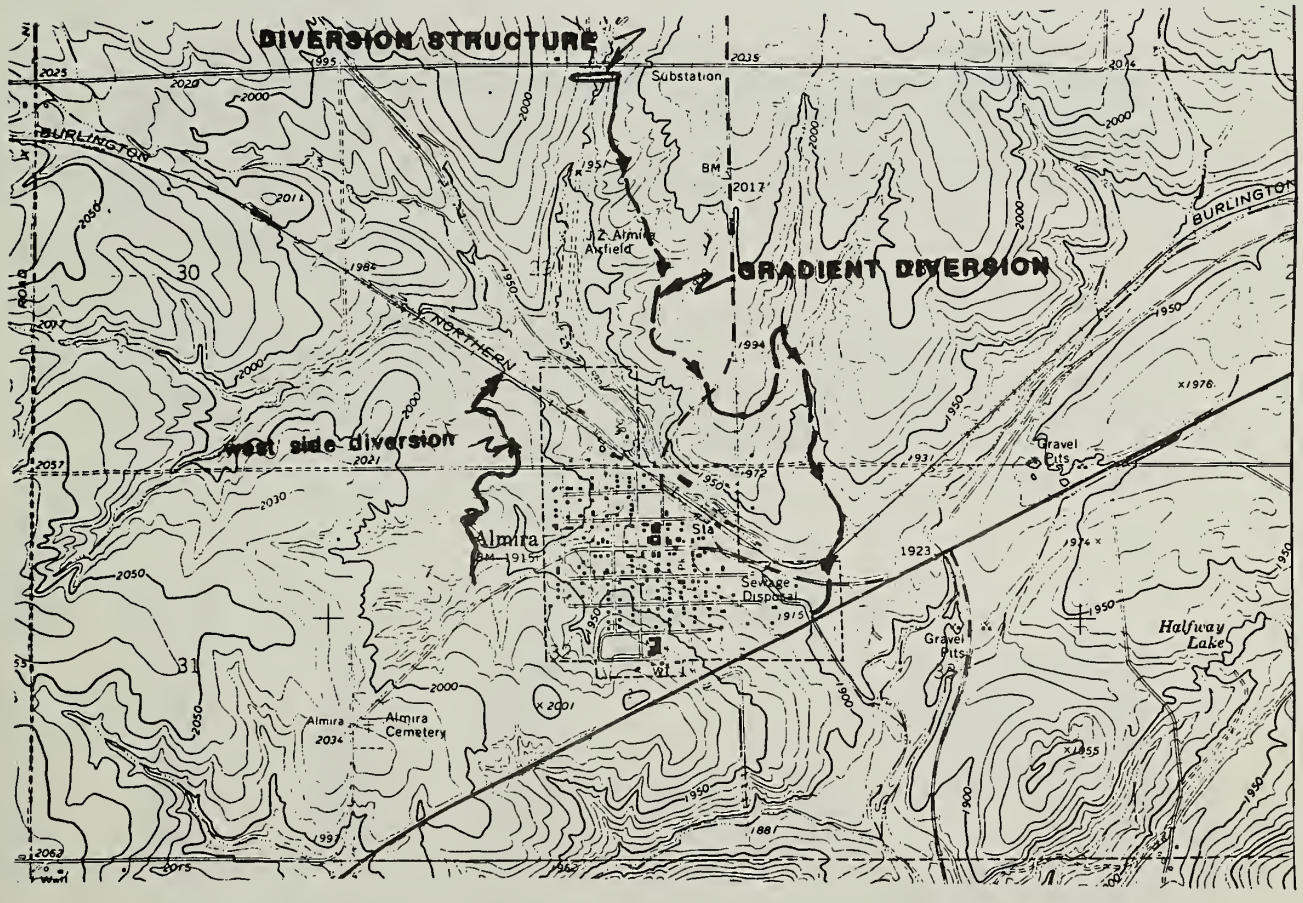


FIGURE 4

ALMIRA FPMS
DIVERSION ALTERNATIVE

SUMMARY COMPARISON TABLE

Alternatives	Area Flooded 100 Year	Average Annual Cost	Average Annual Benefits
DAVIS CREEK DRAINAGE			
Land Treatment		$24,700	$ 6,500
Non-Structural			
Acquisition & relocation		No Est.	No Est.
Floodproofing		No Est.	No Est.
Flood warning		No Est.	No Est.
Flood insurance		No Est.	No Est.
Regulation zoning		No Est.	No Est.
Structural			
Floodwater retarding structure		$59,000	$22,500
Channel improvement		$46,900	$22,500
Diking		$ 9,900	$22,500
Diversions		$54,300	$22,500
WEST SIDE DRAINAGE			
Land Treatment			
Strip cropping and terrace		$ 1,600	$ 500
Diversion		$ 2,000	$ 500
Improved piping and inlet structure		$ 2,900	$ 500

TABLE 1.-Flow in cubic feet per second

	Res. 2	Divert	SEC. 49	SEC. 52	SEC. 10	EST. INSTALLION COSTS
1. Watershed As Is			2256	2135	149	0.0
2. Land Treatment			1777	1677	65	660,000
3. Channel Improve.			2256	2135	149	475,000
4. L.T. + Terrace			1613	1525	62	1,158,000
5. Dam + L.T.	793		1544	1442	62	950,000
6. Divert	1171	1010	953	916	149	550,000
7. Dam (Sec. 29)					149	440,000
8. Diking + Channel Improvement			2256	2135	149	180,000
9. Diking			2256	2135	149	100,000

D. West Side Drainage

Problems of the west side drainage are discussed separately in this section.

The west side drainage contains 320 acres; cropped almost entirely in one field. Water passes through town in a 30 inch concrete pipeline. Alternatives for the area are land treatment, small reservoir and diversions.

1. Land Treatment:

Conservation land treatment alone could alleviate most of the flooding problems from the west side drainage. Flooding is the worst when the watershed is in a fallow condition. A system of strip cropping, with contoured or level terraces, could reduce the peak flow from this area from 148 cubic feet per second to 67. The estimated cost of land treatment is $16,000.

2. Small Reservoirs:

A small reservoir could be built above the 7th Street crossing. This would provide greater head on the existing pipeline, allowing additional water to be passed. Storage within the reservoir, although small, would also reduce the peak flow. Estimated cost of the reservoir and facilities would be $20,000.

3. Diversion:

A short diversion, as shown in Figure 4, could be built west of town to lead the high flows away from the center of town. The diversion would accomplish one aspect of land treatment program in getting contour farming established along that portion of the watershed. Estimated cost of the diversion is $30,000.

SOURCES OF FUNDING AVAILABLE FOR FLOOD CONTROL WORKS OF IMPROVEMENT:

1. Washington State Department of Ecology (WDOE) administers the State of Washington Flood Control Assistance Account Program (FCAAP). Through this program, funding is available to counties on a cost-sharing basis. WDOE will pay 50% of the local cost of improving existing flood control projects. WDOE signs an agreement with the county, who in turn, must sublet an agreement to the local community. For additional information contact Jerry Louthain, Flood Plain Management Supervisor, Olympia (206) 459-6791.

2. United States Corps of Engineers (COE) has a cost-sharing program for assisting local communities with flood control projects. This program is Sec. 205 of the 1948 Federal Flood Control Act. The COE can cost share 50% of cost of planning, design and construction of works of improvement. The local entity must cost share 25% of total cost in cash money. For more information, contact Steve Foster, Corps of Engineers, Seattle (206) 764-3604.

3. USDA's PL-83-566 Small Watershed Program administered by the Soil Conservation Service provides financial and technical assistance to local governments for the planning and constructing of flood prevention projects. This assistance does not include obtaining landrights, which is the sole responsibility of project sponsors. PL-83-566 funds shall bear the entire cost of construction of measures applicable to flood prevention. For more information, contact Paul A. Taylor, Jr., (509) 456-3710.